

Busy year coming up in 2011

Four launches and two solar system encounters on tap through next fall

By Mark Whalen

The Laboratory is primed to spread its reach even farther into the solar system in 2011. Four spacecraft launches and two major encounters by missions in flight highlight what promises to be one of JPL's busiest and most fulfilling years.

Here are some highlights of what's coming up in 2011:



Image shows the aftermath of Deep Impact's visit to Comet Tempel 1. Stardust-NExT is on its way there now for a Feb. 14 flyby.

Stardust-NExT

Comet Tempel 1, which endured a smashing encounter with the Deep Impact mission in 2005, is about to welcome another JPL mission. This time, the Stardust spacecraft is set to follow up its 2006 rendezvous with Comet Wild 2 with a flyby and investigation of Tempel 1 Feb. 14.

The Stardust-NExT (Stardust-New Exploration of Tempel) mission recycles the already "in flight" Stardust spacecraft, which five years ago accomplished the first-ever sample return from a comet with its delivery of interstellar dust and particles from Wild 2 to the Utah desert.

The encounter will update the data gathered on Tempel 1 by Deep Impact, which blasted a crater into the comet—an abyss that scientists have never seen. If successful, Stardust-NExT's attempt to observe the crater will provide the first view of a comet's internal structure, which is critical for studies of the potential dangers of near-Earth objects. Scientists will also survey the 60 percent of the comet not imaged by Deep Impact. Visit <http://stardustnext.jpl.nasa.gov>.

Aquarius

A defining characteristic of ocean water is its relatively high concentration of dissolved salts, or salinity, and even small variations in sea-surface salinity can have dramatic effects on the water cycle and ocean circulation. An instrument developed by JPL for an international mission set for launch June 9 from Vandenberg Air Force Base should go a long way in providing new insight into this critical global process.

Aquarius, the JPL-built and managed primary instrument that will fly on the

Satellite de Aplicaciones Cientificas (SAC-D) spacecraft for NASA's joint mission with Argentina's space agency, will provide a new perspective on the ocean and its links to climate. Aquarius will provide the first-ever maps of seasonal and year-to-year variation in global sea-surface salinity, key information that will be used to discern longer-term changes in oceans and climate.

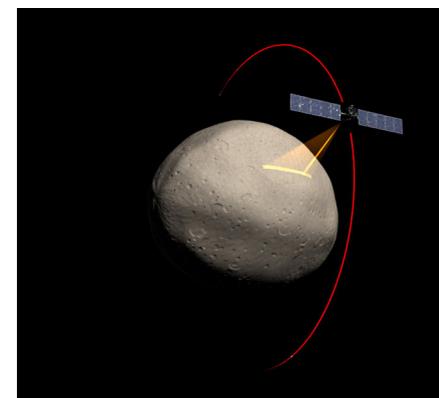
Aquarius will cover Earth's surface once every seven days. During its first few months of its three-year mission, it will acquire as many sea-surface salinity measurements as had been collected from ships and buoys during the previous 125 years. For more information, visit <http://aquarius.nasa.gov>.

Dawn

The ion propulsion-powered Dawn spacecraft, launched in 1997, is set to become the first to orbit two different bodies after leaving Earth when it arrives at Vesta, one of the largest asteroids in the solar system, for a yearlong visit beginning in July.

Dawn will determine the elements that make up the outer parts of the asteroid, measure surface minerals in the visible and infrared, and acquire images with two cameras. Gravity-field measurements will also help determine Vesta's interior.

Vesta and fellow protoplanet Ceres—



Artist's rendition of Dawn spacecraft gathering spectral data from Vesta.

which Dawn will visit in 2015—are located in the asteroid belt between Mars and Jupiter. The pair have followed different evolutionary paths—Vesta is evolved and dry, while Ceres is very primitive and wet—so scientists expect that observing both bodies with the same instrument suite will hold the key to providing deeper insight into planet-forming processes. Visit <http://dawn.jpl.nasa.gov/mission>.

Juno

Juno is scheduled to launch Aug. 5 from Kennedy Space Center to begin a five-year cruise to Jupiter to conduct an in-depth study to understand the origin and evolution of the gas giant.

After a flyby of Earth for a gravity assist in October 2013, the spacecraft will arrive at Jupiter in July 2016 to start a yearlong, polar orbit in which it will come within 3,000 miles (4,800 kilometers) above the planet's cloud tops. Juno's science instruments will determine the amount of water and ammonia in the atmosphere; investigate the existence of an ice-rock core; study convection and deep-wind profiles in the atmosphere; investigate the origin of the Jovian magnetic field; and explore the polar magnetosphere.

The mission will not only advance the understanding of how giant planets form, but can also provide critical knowledge about the planetary systems

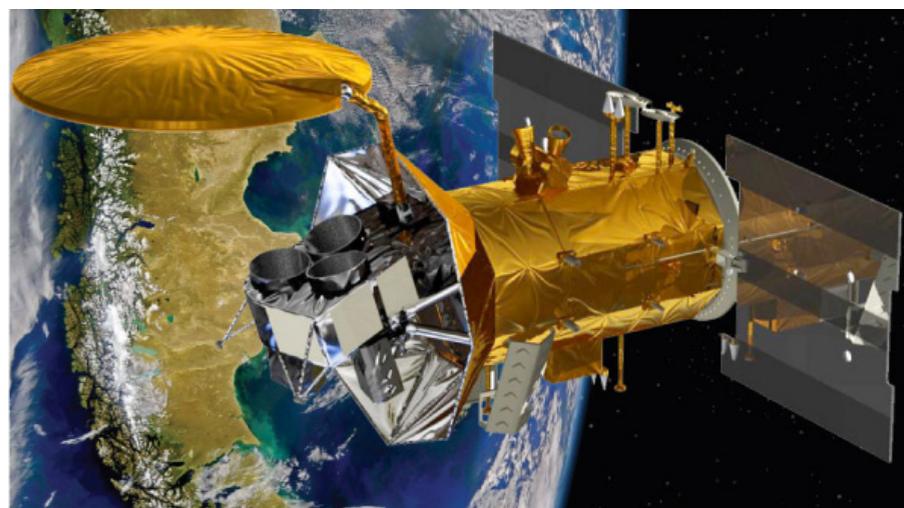
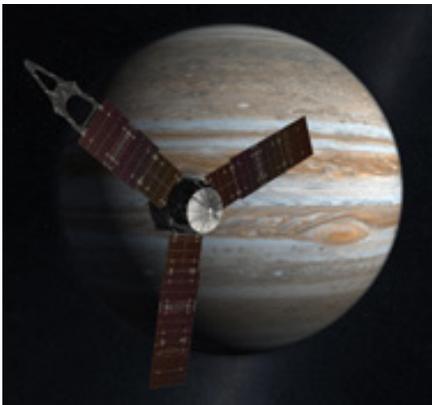


Illustration shows Aquarius/SAC-D above Earth.

Continued on page 2



Juno will reach Jupiter five years after its Aug. 5 launch.

being discovered around other stars. Visit http://www.nasa.gov/mission_pages/juno/main/index.html.

Grail

Does Earth's moon have an inner core? How might secrets about our planet's natural satellite help us understand other bodies in the inner solar system? The Gravity Recovery and Interior Laboratory, or Grail, mission, planned for a Sept. 8 launch from Kennedy Space Center, may soon help scientists find out. The three-month mission will fly twin spacecraft in

tandem orbits around the moon to measure its gravity field in unprecedented detail.

Grail's measurement technique was pioneered by the JPL-managed Gravity Recovery and Climate Experiment, or Grace, mission. Launched in 2002, the Grace satellites measure gravity changes related to the movement of mass within Earth.

Up to five cameras aboard each spacecraft will allow students and the public to participate in Grail's mission. JPL will manage mission operations for Grail, which is part of NASA's Discovery Program. Visit <http://moon.mit.edu>.



Grail will measure the moon's gravity field as never before.

Mars Science Laboratory

NASA's latest foray into the exploration of the Red Planet will get underway with the scheduled Nov. 25 launch of Mars Science Laboratory. The mission's rover, Curiosity, will serve as a robotic geologist on the surface for one martian year (about 687 Earth days) when it arrives in August 2012.

Representing a huge step in Mars surface science and exploration capability, Mars Science Laboratory will demonstrate the ability to land a very large, heavy rover to the surface of Mars as well as the ability to land more precisely in a 20-kilometer (12.4-mile) landing circle. Long-range mobility on the surface (5 to 20 kilometers or about 3 to 12 miles) for the collection of diverse samples and studies will also be demonstrated.

To study Mars' habitability, Curiosity will carry the biggest, most advanced instrument suite ever sent to the planet. The rover will analyze samples scooped from the soil and drilled from rocks, will study the geologic setting to detect chem-



Mars Science Laboratory's Curiosity rover stretches its robotic arm upward during tests.

ical building blocks of life and will assess what the Martian environment was like in the past. Visit <http://marsprogram.jpl.nasa.gov/msl>. ■

2010 IN REVIEW

As JPL prepares for one of the most challenging years in its history, here's a look back at some of the highlights of the Lab's accomplishments over the past year.



JANUARY

JPL's Uninhabited Aerial Vehicle Synthetic Aperture Radar and Advanced Spaceborne Thermal Emission and Reflection Radiometer instrument were used to study deformation caused by the Jan. 12 Haiti earthquake (left) ...

FEBRUARY

Glaciers in west Greenland are melting 100 times faster at their end points beneath the ocean than at their surfaces, according to a study by JPL researchers Eric Rignot and Isabella Velicogna. The results suggest this undersea melting caused by warmer ocean waters is playing an important, if not dominant, role in the current evolution of Greenland's glaciers, a factor that had previously been overlooked....

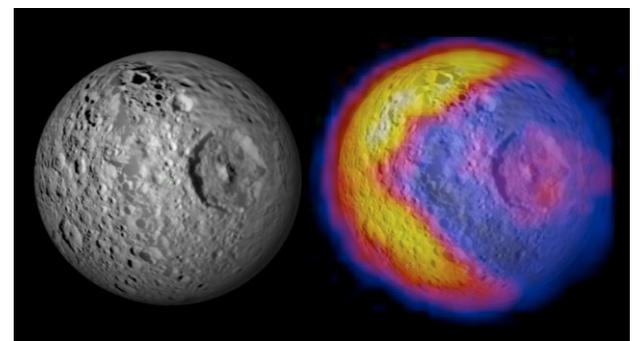
Construction began near Canberra, Australia, to replace the aging 70-meter-wide (230-foot) communication antenna, the first of six new antennas to be installed throughout the JPL-managed Deep Space Network. Each of the DSN complexes—Canberra; Madrid, Spain; and Goldstone, Calif., near Barstow—will have four 34-meter beam-waveguide antennas when the project is completed by 2024.



Calving front of Equip Sermia glacier, West Greenland, one of the four glaciers studied by Rignot and his team....

MARCH

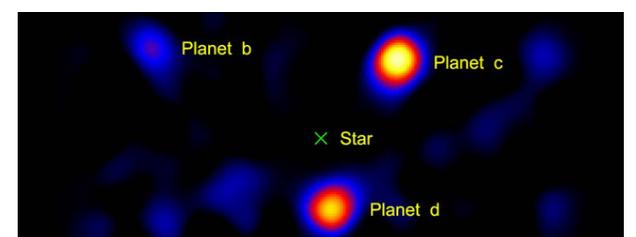
The highest-resolution to date temperature map and images of Saturn's icy moon Mimas obtained by Cassini revealed surprising patterns on the small moon, including unexpected hot regions that resemble "Pac-Man" eating a dot, and striking bands of light and dark in crater walls. Cassini collected the data during its closest flyby of the moon, which is marked by an enormous scar called Herschel Crater (below) and resembles the Death Star from "Star Wars." ...



Mars Exploration Rover Spirit began a months-long hibernation as it transmitted its last command March 22. ...

APRIL

A team of astronomers at JPL snapped a picture of three planets orbiting a star beyond our own using the modest-



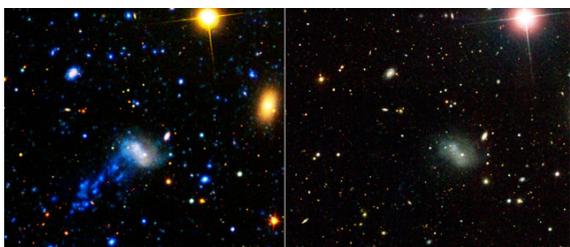
sized Palomar Observatory's Hale Telescope. The new image of the planets, taken in infrared light, was captured using just a 1.5-meter-diameter (4.9-foot) portion of the Hale Telescope's mirror. ...

MAY

An international study co-authored by JPL oceanographer Josh Willis showed that the upper layer of Earth's ocean has warmed since 1993, indicating a strong climate change signal. The study analyzed nine different estimates of heat content in the upper ocean from 1993 to 2008. ...

JUNE

The Galaxy Evolution Explorer discovered a galaxy tail studded with bright knots of new stars (below). The tail, which was created as the galaxy IC 3418 plunged into the neighboring Virgo cluster of galaxies, offers new insight into how stars form. The new observations are teaching us that this heavier, star-forming gas can form in the wake, possibly in swirling eddies of gas, said study lead author Janice Hester of Caltech. ...



NASA kicked off its Summer of Innovation initiative at JPL June 10, a program designed to engage students stimulating math- and science-based education programs. NASA Administrator Charles Bolden and Education Associate Administrator Leland Melvin (both former astronauts, below) shared their personal space-exploration experiences with about 250 middle school students and teachers. ...

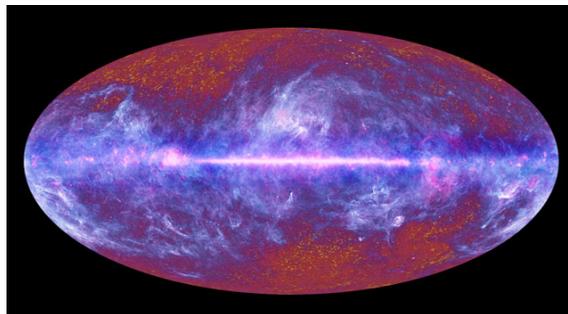


A team led by Y. Tony Song of JPL demonstrated for the first time elements of a prototype tsunami prediction system that quickly and accurately assesses large earthquakes and estimates the size of resulting tsunamis, which could result in better warnings that can save lives and reduce false alarms. After the magnitude 8.8 Chilean earthquake on Feb. 27, the team used data from NASA's Global Differential GPS network, managed by JPL, to successfully predict the size of the resulting tsunami. ...

Minerals in northern Mars craters seen by the European Space Agency's Mars Express orbiter and JPL's Mars Reconnaissance Orbiter suggest that a phase in Mars' early history with conditions favorable to life occurred globally, not just in the south. Southern and northern Mars differ in many ways, so the extent to which they shared ancient environments has been open to question. ...

JULY

An image from the Planck mission shows both our Milky Way galaxy and the universe 380,000 years after the Big Bang in one expansive view (below), said Charles Lawrence, project scientist for the mission at JPL. Planck, a European Space Agency mission with significant NASA participation, has been scanning the whole sky at nine frequencies of light, with the ultimate goal of isolating light from the beginning of time.



AUGUST

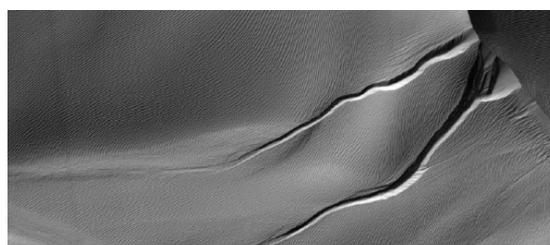
A relatively new type of El Niño, which has its warmest waters in the central-equatorial Pacific Ocean, rather than in the eastern-equatorial Pacific, is becoming more common and progressively stronger, according to a study led by Tong Lee of JPL. In measuring changes in El Niño intensity since 1982, researchers found the intensity of El Niño events in the central Pacific has nearly doubled, with the most intense event occurring in 2009-10. ...

SEPTEMBER

Snowmelt in the Colorado River basin is occurring earlier, reducing runoff and the amount of crucial water available downstream. A new study led by Tom Painter, a snow hydrologist at both JPL and UCLA, shows this is due to increased dust caused by human activities in the region during the past 150 years. The findings have major implications for the 27 million people in the seven U.S. states and Mexico who rely on the Colorado River for drinking, agricultural and industrial water. ...

OCTOBER

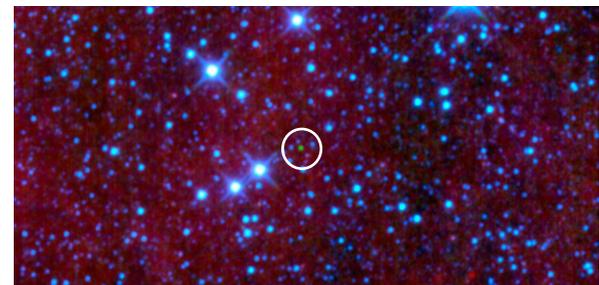
A study led by JPL's Serina Diniega linked fresh Mars gullies to carbon dioxide. Researchers tracked changes in gullies on faces of sand dunes (below) in seven locations on southern Mars. The periods when changes occurred overlapped in all cases with the known winter buildup of carbon-dioxide frost on the dunes. Before-and-after pairs that covered periods only in spring, summer and autumn showed no new activity in those seasons. "Gullies that look like this on Earth are caused by flowing water, but Mars is a different planet with its own mysteries," she said. ...



NOVEMBER

The Epoxi spacecraft on Nov. 4 successfully flew past comet Hartley 2, coming within about 700 kilometers (435 miles) from the comet at closest approach. Initial images from the flyby provided new information about the comet's volume and material spewing from its surface. Early observations also showed that, for the first time, scientists may be able to connect surface activity to individual features on the nucleus. ...

The Wide-field Infrared Survey Explorer eyed its first cool brown dwarf: a tiny, ultra-cold star floating all alone in space. Brown dwarfs appear like green gems (circled below) in WISE images because the



methane in their atmospheres absorbs the infrared light that has been coded blue, and because they are too faint to give off the infrared light that is color-coded red. The only color left is green. ...

The Mars Exploration Rover Opportunity continued to make progress towards Endeavour Crater while collecting remote-sensing science observations along the way. ...

In the first comprehensive global survey of temperature trends in major lakes, researchers Philipp Schneider and Simon Hook of JPL determined Earth's largest lakes have warmed during the past 25 years in response to climate change. The warming trend was global, and the greatest increases were in the mid- to high-latitudes of the Northern Hemisphere. ...

By the end of November more than 1 million people had tuned in to the "Curiosity Cam," which provides a live video feed (<http://www.ustream.tv/channel/nasajpl>) of the assembly and testing of Mars Science Laboratory's rover from a viewing gallery above the cleanroom floor. ...

DECEMBER

On Dec. 15, the 3,340th day since its arrival in October 2001, JPL's Mars Odyssey orbiter passed the Martian career longevity record set by Mars Global Surveyor. ...

JPL's Voyager 1 spacecraft, in flight for 33 years, has crossed into an area where the velocity of the hot ionized gas, or plasma, emanating directly outward from the sun has slowed to zero. "Voyager 1 is getting close to interstellar space," noted Voyager Project Scientist Ed Stone. ...

Cassini found possible ice volcanoes on Titan that are similar in shape to those on Earth that spew molten rock. Topography and surface composition data enabled scientists to make the best case yet in the outer solar system for an Earth-like volcano landform that erupts in ice.

News Briefs



Bill Patzert

Patzert honored for spreading the word

JPL oceanographer and climatologist Bill Patzert has been honored by the American Geophysical Union with its 2010 Athelstan Spilhaus Award for his contributions to improving public understanding of Earth science.

Patzert received the award at a Dec. 15 ceremony at the American Geophysical Union's Fall Meeting in San Francisco. The Athelstan Spilhaus Award honors American Geophysical Union members who have devoted parts of their lives to enhancing public understanding of Earth and space science. Established in 2003, the

award is named in honor of Athelstan F. Spilhaus Sr., a geophysicist and meteorologist who made groundbreaking contributions to science, education and public service.

Patzert, who joined JPL in 1983, has served as the face and voice of JPL oceanography and climate change to local, regional, national and international news outlets for more than a quarter century. A strong supporter of NASA's outreach and education efforts, Patzert frequently speaks to schools and environmental and business groups about the importance of Earth's ocean and climate science.

"To me, the Spilhaus Award is about the passionate telling of science stories," said Patzert. "Communicating science to the public isn't always easy, but it is always essential. Today, perhaps more than at any time in the past, it is vital that scientists tell compelling, correct and understandable stories, because we live in a time when climate science and scientists are under fire."

Siegel will lead terahertz journal

Peter Siegel, supervisor of the Submillimeter Wave Advanced Technology Group, has been named editor in chief of the new Institute of Electrical and Electronics Engineers journal "Transactions on Terahertz Science and Technology."

The journal, which targets all disciplines involved in terahertz science and technology, will debut in print September 2011. Papers received between now and September will appear in the

digital library IEEE Xplore (<http://ieeexplore.ieee.org>) before the print issue, as will articles slated for subsequent print issues. A second print issue is set for November 2011, with six issues scheduled for 2012 and added issues as the paper count mounts.

Siegel will oversee content, appearance, editorial structure, and review processes and editorial board selection, among other duties. He said the journal is now accepting submissions of papers, with the inaugural issue having 28 paper commitments from leaders in the terahertz field around the world and crossing many fields.



Vatché Vorpérian

Vorpérian earns fellow designation

Vatché Vorpérian, a senior member of the technical staff in the Power and Sensor Electronics Group, has been named a Fellow of the Institute of Electrical and Electronics Engineers.

Vorpérian, who has been with JPL since 1991, works on research and development of power electronics circuits for space applications and micro electro mechanical systems devices for micro seismometers and micro gyroscopes. The institute said he was recognized for his contributions to pulse-width modulated and resonant converters.

A 1984 graduate of Caltech, Vorpérian previously taught electrical engineering at Virginia Tech and has taught numerous professional advancement courses to industry in power electronics and analytical techniques in electronics circuit analysis. He is the author of the book "Fast Analytical Methods in Electrical and Electronic Circuits."

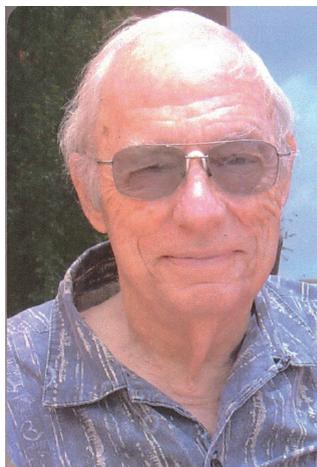
Small business award goes to ATA

JPL has named San Diego-based ATA Engineering Inc. the 2010 Small Business Subcontractor of the Year, one of 10 awards presented by each of NASA's 10 field centers.

The honor recognizes companies that "provide value-added and outstanding support—on schedule and within cost—and innovative solutions to problems/issues that arise in the execution of the contract."

ATA was nominated for its work in support of multiple JPL spacecraft and science programs, including Mars Science Laboratory. The company has provided JPL with structural, thermal, and testing engineering services since 2004.

Passings



Kenneth McGraw

Retired JPL systems engineer **Kenneth McGraw**, 70, died Oct. 15.

McGraw worked at JPL from 1968 to 2002. He is survived by his wife, Jane Okinishi; daughter Tanya, son-in-law Toby and grandchildren Issac and Eva.

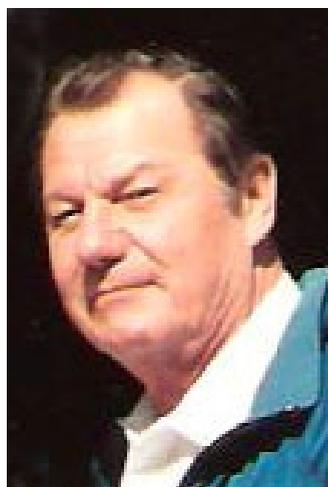
Services were held in Sedona, Ariz.

Joseph Toczylowski, 77, a retired electrical engineer, died Dec. 8.

Toczylowski joined the Lab in 1976 and retired in 2002. He headed the Power Electronics Laboratory in Division 34 and also contributed to Cassini, the Shuttle Radar Topography Mission, Microwave Limb Sounder

and a host of earlier JPL missions.

He is survived by children Carol, Debbie, Mary and Joseph, and sister Helen. Services were held Dec. 12 in New Jersey.



Joseph Toczylowski

Letters

On behalf of my father (Ed Bennett) and myself, I would like to thank our group and our projects for supporting us during the illness and death of his mother-in-law/my grandmother. It meant a lot to us to be able to take the time off to be with our family and celebrate her life. We would also like to thank JPL for the lovely plants that

were sent to our homes. We know she would have liked them, too.

Marie-Ann Carroll, Section 172

My wife and I thank everyone for the kind thoughts and for the very pretty orchid and vase sent to our house. The death of my wife's father was not unexpected, but it still leaves a void. Your sentiments and the flower were very much appreciated. Thanks.

Albert Whittlesey

Thanks to my friends and colleagues in the Human Resources organization for their thoughts and prayers on the passing of my mother, Claire. Also thanks to JPL for the thoughtfulness of the beautiful plant.

Mae Hawk

The Laskin family would like to extend its warmest thanks to friends and colleagues at JPL who were so caring and wonderful to us upon the death of Meyer Laskin, Bob's father. Thanks also for the lovely plant and its reminder that life goes on.

Robert Laskin

I would like to thank my co-workers in the Library, Archives and Records Section for my retirement party. I am grateful to the LARS staff and all my friends at JPL for making the last 30 years (yikes!) such a wonderful experience. Thank you to the scientists and engineers who brought space exploration into my life. It has been a terrific way to spend 30 years.

Best regards,

Jennifer Momjian

JPL colleagues: Thank you very much for the wonderful card, healthy plant and kind words regarding the passing of my father. You are truly amazing co-workers. I am so grateful to work with such caring and supportive colleagues.

Brian Morrison

Retirees

The following JPL employees retired in December:

Adeline Carr, 43 years, Section 2620; **Margaret Bundschuh**, 42 years, Section 2232; **Eddy Shalom**, 33 years, Section 3401; **Michail Zak**, 33 years, Section 316H; **Sheryl Jackson**, 31 years, Section 2691; **Constance McCaig**, 31 years, Section 2722; **William Poirier**, 28 years, Section 2724; **Gerald Kalish**, 27 years, Section 2722; **Krystal Poole**, 25 years, Section 2745; **Luanne Cathey**, 24 years, Section 2032; **Darlene Banks**, 23 years, Section 1080; **Robert Gregg**, 23 years, Section 2133; **Patricia Smith**, 23 years, Section 173A; **Henry Dillard**, 22 years, Section 173H; **Irena Hungerford**, 21 years, Section 2242; **James Kowalski**, 19 years, Section 3456; **Christopher Catherasoo**, 13 years, Section 1733; **James Wilson**, 12 years, Section 337A; **Laura McCullough**, 11 years, Section 2113.

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